

## A review of *Eilema* Hübner, 1819 of Russia and adjacent territories. Part 1. The *Eilema griseola* (Hübner, 1803) species group (Arctiidae: Lithosiinae)

NIKOLAY N. IGNATYEV<sup>1</sup> & THOMAS J. WITT<sup>2</sup>

<sup>1</sup> Department of Zoology, pl. 100-letiya Lenina 4, State Pedagogical University, 432700 Uljanovsk, Russia; e-mail: ignatyev\_nik@mail.ru

<sup>2</sup> Entomologisches Museum und Bibliothek, Tengstr. 33, 80796, Munich, Germany; e-mail: thomas@witt-thomas.com

**Abstract.** The species of the *Eilema griseola* (Hübner, 1803) group of subgenus *Collita* Moore, 1878, are revised and illustrated. Diagnoses and distribution data are given for the seven species so far included. One new species, *Eilema digna* sp. n. (type locality: Russia, Far East, Primorye, village Kamenushka) is described. *Eilema griseola sachalinensis* Matsumura, 1930 is the Sakhalin subspecies of *E. griseola*. *Eilema submontana* Inoue, 1982, is considered to be the Japanese subspecies of *griseola* Hübner and not a synonym of *E. vetusta* Walker. *Lithosia vetusta* Walker, 1854 is a senior synonym of *Lithosia griseola* var. *amurensis* Staudinger, 1892, syn. n. *Eilema vetusta* Walker, 1854 is considered to be a valid species. *Lithosia adaucta* Butler, 1877, syn. n. is a synonym of *E. vetusta aegrota* (Butler, 1877) and the latter is the Japanese subspecies of *E. vetusta* Walker. *Eilema chinensis* (Daniel, 1954) is a valid species restricted to China. *Eilema gina* Okano, 1955 is considered to be a valid species restricted to Japan, probably a vicariant to *Eilema coreana* (Leech, 1888), and not a synonym of the latter. Lectotypes are designated for *Lithosia griseola amurensis* Staudinger, 1892, *Lithosia sachalinensis* Matsumura, 1930 and *Lithosia griseola chinensis* Daniel, 1954.

**Zusammenfassung.** Die Arten des *Eilema griseola* (Hübner, 1803)-Komplexes der Untergattung *Collita* Moore, 1878 werden revidiert. Diagnosen und Verbreitungsdaten werden für sieben derzeit bekannte Arten angegeben. Eine neue Art, *Eilema digna* sp. n. (locus typicus: Russland, Fern Ost, Dorf Kamenuschka), wird hier beschrieben und abgebildet. *Eilema griseola sachalinensis* Matsumura, 1930 ist die Unterart von *griseola* aus Sachalin, *Eilema submontana* Inoue, 1982 wird als japanische Unterart von *Eilema griseola* eingestuft als Synonym von *E. vetusta* Walker. *Lithosia vetusta* Walker, 1854 ist ein älteres Synonym von *Lithosia griseola* var. *amurensis* Staudinger, 1892, syn. n. *Eilema vetusta* Walker, 1854 wird als gültige Art angesehen. *Lithosia adaucta* Butler, 1877, syn. n. ist ein Synonym von *E. vetusta aegrota* (Butler, 1877) und die letztere ist die japanische Unterart von *E. vetusta* Walker. *Eilema chinensis* (Daniel, 1954) ist eine gültige, auf China beschränkte Art. *Eilema gina* Okano, 1955 wird als gültige, auf Japan beschränkte Art angesehen, wahrscheinlich ist sie eine Vikariante von *Eilema coreana* (Leech, 1888) und nicht ein Synonym der letzteren. Lectotypen werden für *Lithosia griseola amurensis* Staudinger, 1892, *Lithosia sachalinensis* Matsumura, 1930 und *Lithosia griseola chinensis* Daniel, 1954 festgelegt.

**Резюме.** В данной статье ревидован комплекс *Eilema griseola* (Hübner 1803), рассматриваемый в ранге подрода *Collita* Moore, 1878. Для 7 включенных видов даны диагнозы и информация по распространению; один из них, *Eilema digna* sp. n. (типовое местонахождение: Россия, Приморье, дер. Каменушка), описывается как новый. В результате исследования типового материала произведены следующие номенклатурные акты: установлена новая комбинация *Eilema griseola sachalinensis* (Matsumura, 1930) для сахалинского подвида *E. griseola*. *Eilema submontana* Inoue, 1982, рассматривается в ранге японского подвида *griseola* Hübner и изымается из синонимии с *E. vetusta* Walker, в то время как *Lithosia vetusta* Walker, 1854 признается хорошим самостоятельным видом и старшим синонимом *Lithosia griseola* var. *amurensis* Staudinger, 1892, syn. n. *Lithosia adaucta* Butler, 1877, syn. n., является синонимом *L. aegrota* Butler, 1877; последний, в свою очередь, – японским подвидом *E. vetusta* Walker. *Eilema chinensis* (Daniel, 1954) признается валидным видом, населяющим Китай, а *Eilema gina* Okano, 1955 – валидным видом, населяющим Японию. Последний, возможно, является островным викириантом *Eilema coreana* (Leech, 1888), но не его синонимом. Для *Lithosia griseola amurensis* Staudinger, 1892, *Lithosia sachalinensis* Matsumura, 1930 и *Lithosia griseola chinensis* Daniel, 1954 выделены лектотипы.

## Introduction

This paper is dedicated to the *E. griseola* (Hübner, 1803) species group of the genus *Eilema* Hübner, 1819 (Arctiidae: Lithosiinae). At present, this group includes seven species.

Several features mentioned below distinctly separate this group from related species groups and characterize it as monophyletic. To denominate this group the name *Collita* Moore, 1878, (Proc. zool. Soc. London 1878: 16) with type-species: *Bombyx griseola* Hübner, 1803, by original designation, is valid. We consider this group to be equivalent to *Collita* at the rank of a subgenus within the genus *Eilema*.

This paper is the first in a series devoted to *Eilema* sensu lato. The investigations in the other groups of the genus will be continued by the authors. The main aim of this paper is to revise the *Eilema griseola* species group in the limits of the former USSR and neighbouring territories in order to define clearly the status of the names involved. For this purpose, all available primary types and comparative material from different museums were analysed. Most of the material examined is deposited in Museum Witt, Munich [MWM].

## Abbreviations

BMNH	Natural History Museum, (London, U.K.)
DEHU	Department of Entomology, Hokkaido University (Japan)
GU	genitalia slide
MWM	Museum Witt, Munich (Germany)
SPbGU	Sankt Petersburg State University (Russia)
UIGPU	State Pedagogical University of Uljanovsk (Russia)
ZFMK	Zoologisches Forschungsinstitut und Museum A. Koenig (Bonn, Germany)
ZISP	Zoological Institute of the Russian Academy of Sciences (St. Petersburg, Russia)
ZMHUB	Zoologisches Museum der Humboldt Universität zu Berlin (Germany)
ZMKU	Zoological Museum of Kiev University (Ukraine)
ZMMGU	Zoological Museum of Moscow State University (Moscow, Russia)
ZSM	Zoologische Staatssammlung des Bayerischen Staates (Munich, Germany).

## Checklist of *Eilema* Hübner, 1819

- Eilema griseola* (Hübner, 1803)  
*Eilema griseola griseola* (Hübner, 1803)  
*Eilema griseola submontana* Inoue, 1982  
*Eilema griseola sachalinensis* Matsumura, 1930  
*Eilema vetusta* (Walker, 1854)  
*Eilema vetusta vetusta* (Walker, 1854)  
 = *Lithosia griseola* Hb. var. *amurensis* Staudinger, 1892, **syn. n.**  
*Eilema vetusta aegrota* (Butler, 1877)  
 = *Lithosia adaucta* Butler, 1877, **syn. n.**  
*Eilema coreana* (Leech, 1888)  
*Eilema gina* Okano, 1954 [1955]  
*Eilema okanoi* Inoue, 1961  
 = *Eilema griseolum montana* Okano, 1954 [1955] (nec Aurivillius, 1910), *praeocc.*  
*Eilema digna* Ignatyev & Witt, **sp. n.**  
*Eilema chinensis* (Daniel, 1954)

### The *Eilema* (*Collita*) *griseola* (Hübner, 1803) species group

**Description.** A dult. Middle-sized (wingspan 17–38 mm) moths; forewing shape with costal margin distinctly concave; forewing colour mainly grey without bright yellow costal streak; costal margin of male forewing with dark (almost black) scales at base (not present in females); hindwing grey or yellow (with different gradations) (on the whole, European populations are darker than those of the East); head, front, and tegulae grey or yellow (with different gradations); patagia with dark scales at tip.

**Male genitalia.** Uncus long, curved and slightly sharpened at apex. Socii and gnathos absent. Juxta highly modified and transformed into pointed, sometimes slightly curved, process (here called “ramus”). Valvae mostly asymmetrical, flattened, sclerotized, serrate at outer margin, and bearing curved apical thorn. Left valva with sharpened saccular appendage. Phallus tubular, narrower distally, with apical spur sometimes bifurcate. Vesica bag-shaped, elongate, usually with 5–9 strong cornuti and elongate zone of spine-like scobination on opposite side.

**Female genitalia.** Vaginal plates absent. Papillae analis rounded. Corpus bursae oviform with two normally rounded signa. Ductus seminalis long, curved spirally, and entwined about bursa. Ductus bursae with sclerotized protuberance at base.

**Diagnosis.** The external characters stated above are of little diagnostic value because they are very variable in each taxon within *Eilema* sensu lato. However, the male genitalia are diagnostic to separate the group from its relatives, especially the strongly modified valvae, characteristic shape of bifurcate phallus, and equipment of vesica.

### *Eilema* (*Collita*) *griseola* (Hübner, 1803)

Figs 1–9, 25–28, 37–41

*Bombyx griseola* Hübner, 1803: 126, pl. 23 fig. 97. Type locality: ‘Deutschland’ (Germany).

**Description.** A dult (Figs 1–9). Wingspan 26–36 mm. Forewing dark to pale grey, yellowish or white testaceous, with narrow costal margin of pale scales. Hindwing mostly grey or yellow, paler than forewing.

Head, front, and tegula yellow; patagia with admixture of grey scales at tip.

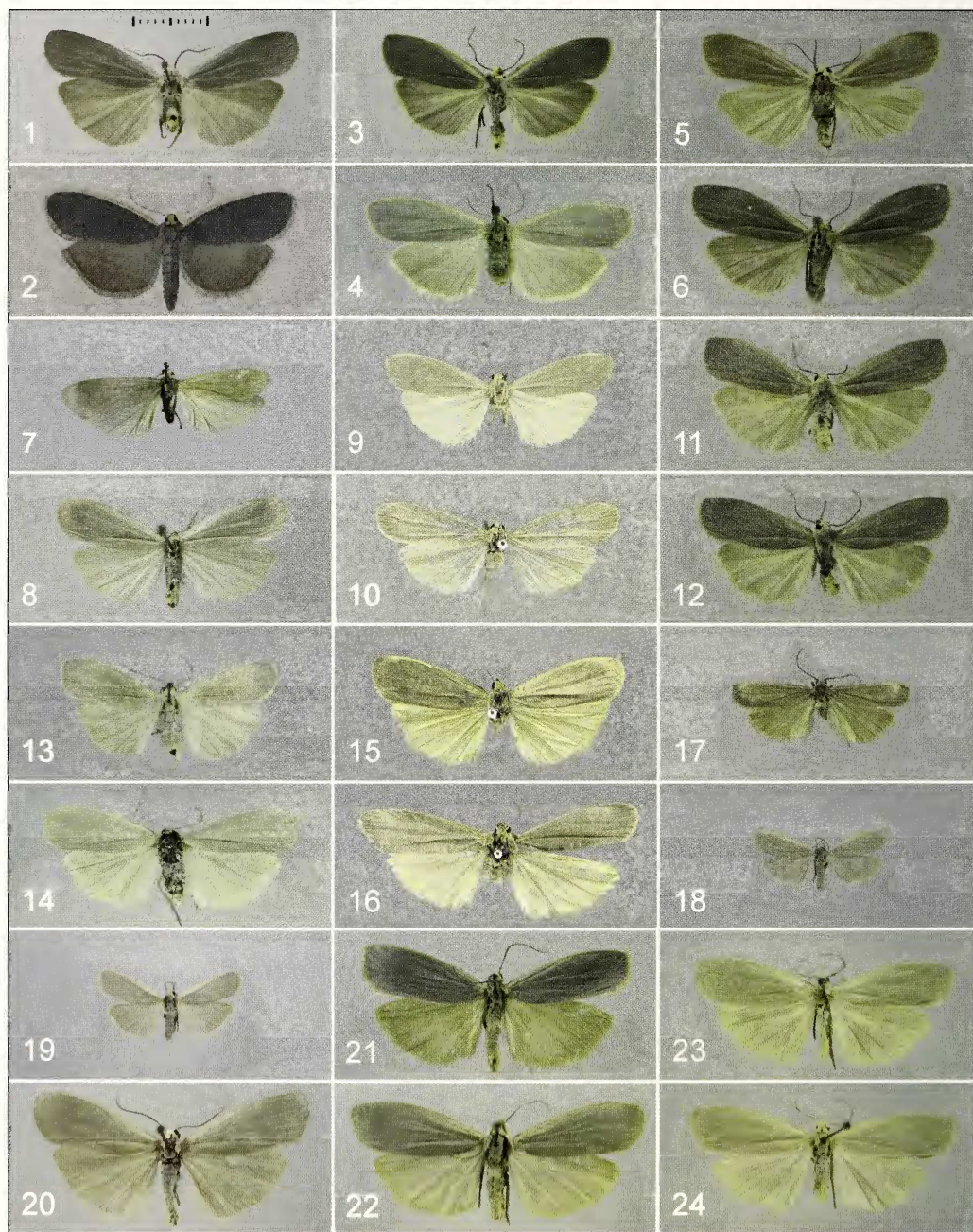
**Male genitalia** (Figs 25–28). Valvae asymmetrical; left sacculus with appendage curved and sharpened at tip. Phallus with terminal bifurcation; vesica elongate bearing mostly cornuti.

**Female genitalia** (Figs 37–41). Ductus seminalis long, twisted around oviform corpus bursae. Sclerotized plate of ductus bursae with apex directed anteriorly and widened distally. Corpus bursae with two signa.

**Diagnosis.** The characteristic terminal bifurcation of the phallus in the male genitalia and the presence of a sclerotized plate on ductus bursae in the female genitalia are specific for *E. griseola*.

**Remarks.** Three subspecies are distinguished: *E. griseola griseola* (Hübner, [1803]), *E. griseola sachalinensis* (Matsumura, 1930), and *E. griseola submontana* Inoue, 1982.





*Eilema (Collita) griseola griseola* (Hübner, 1803)

Figs 1–6, 25, 26, 37–40

**Description.** A dult (Figs 1–6). Wingspan 28–36 mm. Forewing dark to pale grey (specimens of Altai population usually sand-coloured), with narrow costal margin of pale scales; base of costal stripe dark grey (almost black). Hindwing of most European specimens grey, paler than forewing, with costal margin covered with pale (usually



pale-yellow) scales. Head, front, and tegula yellow; patagia with admixture of grey scales at tip.

Male genitalia (Figs 25, 26). Valva with serrate outer margin; left sacculus with appendage curved and sharpened at tip. Vesica elongate, bearing 3–9 (mostly 5–8) large cornuti and several smaller ones on opposite side.

Female genitalia (Figs 37–40). As described above.

**Diagnosis.** The larger size, broader wings, and irregular serrating of the outer margin of the valva are diagnostic.

**Distribution.** The species is widely distributed (Fig. 48). It is known from Western Europe (where its range was mapped by de Freina & Witt, 1987: map 34); Baltic States, Bielorrussia, Moldova, Ukraine (Kiev and Donetsk Regions), Crimea. It is known from the following Regions of the Russian territory: Karelia, St. Petersburg (Lodeinopolsky district, Zaoostrovie), Moscow, Tula, Voronezh, Ulyanovsk, Penza, Saratov, Stavropol, Sverdlovsk, Chelyabinsk, Tyumen, Omsk, Novosibirsk, Tomsk, Barnaul, Krasnoyarsk, Ulan–Ude (Buryatia), as well as from Tataria, Chuvashia, Mordovia, and Bashkiria Republics (cf. Dubatolov & Zolotareno, 1990). Easternwards, it is known from the Russian Far East (Amur Region (Zeya river), Khabarovsk, Vladivostok), where it flies in sympatry with two other species of the *E. griseola* group. The same subspecies is also known from the Shantarskie islands (1♂, Buchta Abrek, Siycheva, Leto [Summer] 912 [ZISP]) as well as from China (Manchuria) and Korea.

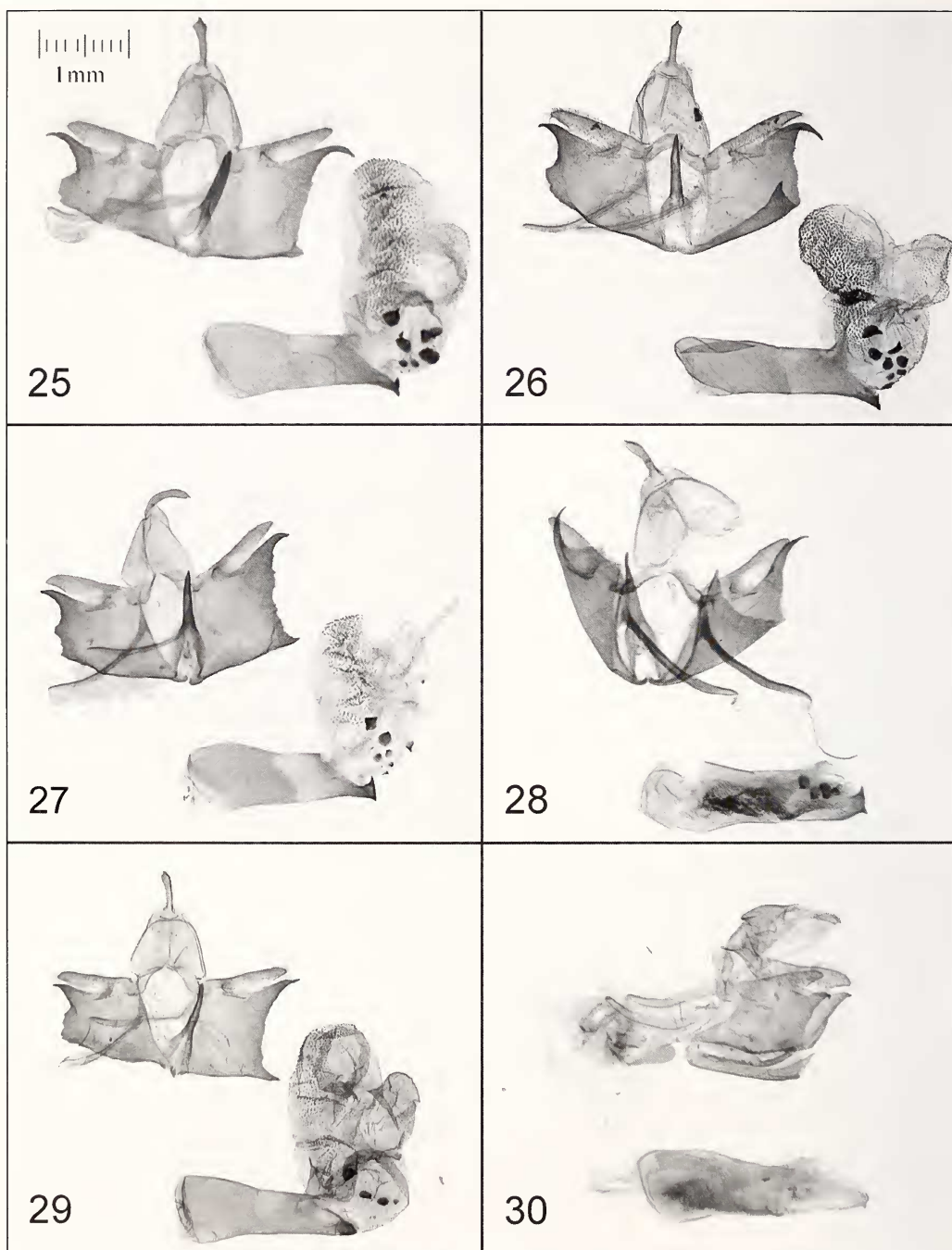
**Remarks.** Despite the heterogeneity of the continental East Asian populations concerning the colouration of the forewing, and the usually paler hindwings, we consider them as a single subspecies.

### *Eilema (Collita) griseola sachalinensis* (Matsumura, 1930)

Figs 7, 8, 27, 41

*Lithosia sachalinensis* Matsumura, 1930: 38, pl. 1 fig. 6. Type locality: [Far East of Russia, Sachalin island] ‘Saghalien ... at Ruikoff’. Lectotype: male (DEHU), **here designated**.

**Figs 1–24.** Moths of *Eilema griseola* Hbn.-group. **1.** *Eilema griseola* Hübner, ♂, Germany, Südbayern, Freising [MWM]. **2.** *Eilema griseola* Hübner, ♂, from the original description. **3.** *Eilema griseola griseola* Hübner, ♂, Ukraine, Kiev circuitus [MWM]. **4.** *Eilema griseola griseola* Hübner, ♀, Ukraine, Prov. Lwow, distr. Jaworow [ZMKU]. **5.** *Eilema griseola griseola* Hübner, ♂, Russia, Far East, South Primorye, Region Chassan, Rjazanovka [MWM]. **6.** *Eilema griseola griseola* Hübner, ♀, Russia, South Primorye, Pogranitshnyi [MWM]. **7.** *Eilema griseola sachalinensis* Matsumura, ♂, lectotype of *Lithosia sachalinensis* Mats. [MWM]. **8.** *Eilema griseola sachalinensis* Matsumura, ♀, USSR, South Sakhalin, Juzhno-Sakhalinsk [MWM]. **9.** *Eilema griseola submontana* Inoue, ♂, holotype of *Eilema submontana* Inoue [BMNH]. **10.** *Eilema vetusta* Walker, ♀, holotype [BMNH]. **11.** *Eilema vetusta vetusta* Walker, ♂, Russia, Far East, Primorye Reg., 20 km East from Kirovsky, Ussuri riv. valey [MWM]. **12.** *Eilema vetusta vetusta* Walker, ♂, Russia, Far East, Primorye Reg., Kirovsky env., 3 km West from Krylovka vill., Fortochka Pass, altitude 300 m [MWM]. **13.** *Eilema vetusta vetusta* Walker, ♂, lectotype of *Lithosia griseola amurensis* Staudinger [ZMHUB]. **14.** *Eilema vetusta vetusta* Walker, ♀, Russia, Far East, Ussuri, Okeanskaya [ZMKU]. **15.** *Eilema vetusta aegrota* Butler, ♂, holotype of *Lithosia aegrota* Butler [BMNH]. **16.** *Eilema vetusta aegrota* Butler, ♀, holotype of *Lithosia adaucta* Butler [BMNH]. **17.** *Eilema coreana* Leech, ♂, holotype [BMNH]. **18.** *Eilema gina* Okano, ♂♂, Japan, Wariyama, Araya, Akita city [MWM]. **19.** *Eilema gina* Okano, ♀, Japan, Wariyama, Araya, Akita city [MWM]. **20.** *Eilema okanoi* Inoue, ♀, Japan, Kyushu, Fukuoka Pref., Mt. Hikosan, 800 m. [MWM]. **21.** *Eilema digna* Ignatyev et Witt, sp. n., ♂, holotype [MWM]. **22.** *Eilema digna* Ignatyev et Witt, sp. n., ♀, paratype [MWM]. **23.** *Eilema chinensis* Daniel, ♂, lectotype of *Lithosia griseola chinensis* Daniel [ZFMK]. **24.** *Eilema chinensis* Daniel, ♀, paralectotype of *Lithosia griseola chinensis* Daniel [ZFMK].



**Figs 25–30.** Male genitalia. **25.** *Eilema griseola griseola* Hübner, Russia, North Altai, Kamlak near Ust'-Sema (GU 10.974) [MWM]. **26.** *Eilema griseola griseola* Hübner, USSR, Far East, Sikhote Alin Mts., Yasnoe (GU 11.058) [MWM]. **27.** *Eilema griseola sachalinensis* Matsumura, lectotype of *Lithosia sachalinensis* Mats. (GU 11.077) [MWM]. **28.** *Eilema griseola submontana* Inoue, holotype of *Eilema submontana* Inoue (Arctiidae genitalia slide No. 4402) [BMNH]. **29.** *Eilema vetusta vetusta* Walker, Russia, Far East, Primorye Reg., 20 km East from Kirovsky, Ussuri riv. valley (GU 10.986) [MWM]. **30.** *Eilema vetusta aegrota* Butler, holotype of *Lithosia aegrota* Butler (Arctiidae genitalia slide No. 688) [BMNH].



**Description.** Adult (Figs 7, 8). Wingspan 26–28 mm. Forewings monotonous grey. Male genitalia (Fig. 27). Of same ground plan as nominate subspecies but generally smaller. External margin of valvae finely serrated. Phallus tubular, more slender caudally, with apical bifurcation. Vesica with 5–7 large cornuti and several smaller cornuti on opposite side.

Female genitalia (Fig. 41). As in nominate subspecies.

**Diagnosis.** The monotonous colouration of the forewings and the finely serrated external margin of the valvae are the main characteristics of this subspecies.

**Distribution.** The subspecies is native to Sakhalin, where it is the only member of the group.

**Remarks.** Because of characters pointed above, we propose a new status for the population of Sakhalin as a geographical subspecies of *Eilema griseola*: *E. griseola sachalinensis* (Matsumura, 1930). Surprisingly, this taxon was overlooked by most scientists and is absent in modern lists (cf. Dubatolov et al., 1993).

In the original description, Matsumura (1930) stated for his *Lithosia sachalinensis* (p. 38) “3 male specimens were collected at Ruikoff by H. Kono and K. Tamanuki (4.VIII 1922)”. These three syntypes were recently found by Dr V. Zolotuhin in the collection of the Hokkaido University. For taxonomic stability (ICZN Article 74) a lectotype for *Lithosia sachalinensis* Matsumura, 1930 is designated here: The male bears a white, printed rectangular locality label with “Kitakarafuto | Kono Tamanuki” with an ink inscription on back side “[in Japanese] | 4. Aug 22”, a red printed label with “-type” in right upper corner and inscription by hand in black ink “*Lithosia sachalinensis* | Mats. 1930”, a white rectangular label with black frame and printed with “det. Matsumura”, a white rectangular label with inscription by hand in black ink “Mats. | *L. sachalinensis*” and an inscription by Matsumura’s hand in black ink “*griseola vetusta* Wlk”, and Ignatyev’s label genitalia slide “Hokkaido-Uni | Arctiidae | GU 2007-05”. It has received an additional red printed label with “LECTOTYPE | ♂ *Lithosia sachalinensis* | Mats., 1930 | des. Ignatyev & Witt”. The lectotype is kept in the Department of Entomology, Hokkaido University (Sapporo, Japan). The other two male syntypes are considered to be paralectotypes.

### *Eilema (Collita) griseola submontana* Inoue, 1982

**Figs 9, 28**

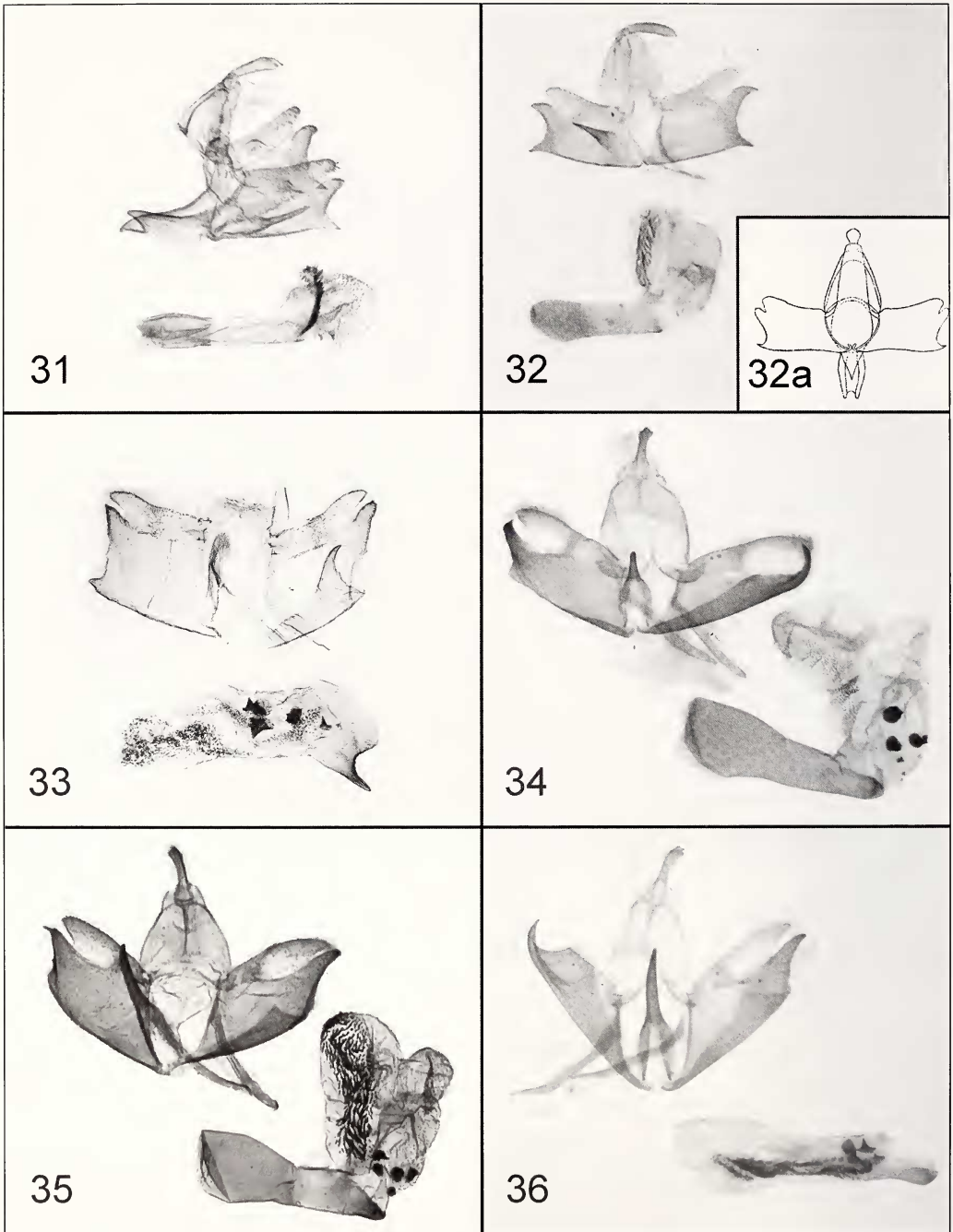
*Eilema submontana* Inoue, 1982: 640; 2: pl. 155 fig 24. Type locality: Japan, Kanvosen Rishiri Isl., Hokkaido. Holotype: male (BMNH).

**Description.** Adult (Fig. 9). Wingspan 28–32 mm. Forewing yellowish or sandy coloured, with narrow costal margin of pale scales; base of costal stripe dark grey (almost black). Hindwing paler than forewing, with costal margin covered with pale (usually yellowish) scales. Head, front, and tegula yellow; patagia with admixture of grey scales at tip.

Male genitalia (Fig. 28). As in nominate subspecies.

Female genitalia. Unknown.

**Diagnosis.** It differs from the nominate subspecies in being paler and sandy coloured. Also, the forewing is more rounded than in the nominate subspecies.



**Figs 31–36.** Male genitalia. **31.** *Eilema coreana* Leech, holotype (Arctiidae genitalia slide No. 680) [BMNH]. **32.** *Eilema gina* Okano, Japan, Wariyama, Araya, Akita city (GU 11.493) [MWM]. **32a.** *Eilema gina* Okano, from the original description (Okano, 1954 [1955]: fig. 3). **33.** *Eilema okanoi* Inoue, from “Moths of Japan” 1982: pl. 346, fig. 2 [MWM]. **34.** *Eilema digna* Ignatyev et Witt, sp. n., holotype (GU 10.984) [MWM]. **35.** *Eilema chinensis* Daniel, lectotype of *Lithosia griseola chinensis* Daniel (GU ARC-010) [ZFMK]. **36.** *Eilema chinensis* Daniel, paralectotype of *Lithosia griseola chinensis* Daniel (Präp. Nr. 524) [MWM].



**Distribution.** The subspecies is native to Japan (Hokkaido, Honshu). It is probably also known from the Kuril islands (recorded by Dubatolov et al. (1993) from Kunashir as *E. aegrota* but the identification of this record was not checked by the authors and needs verification).

**Remarks.** *Lithosia submontana* Inoue, 1982, was correctly considered by Dubatolov (1991) as conspecific with *E. griseola* Hübner, and he established the new combination *E. griseola* ssp. *submontana* Inoue (Dubatolov 1991: 185). But two years later, he changed this point of view and attributed *submontana* Inoue to *Eilema griseola vetusta* (Walker, 1854). (Dubatolov et al. 1993: 170). The analysis of the genitalia of both corresponding types proves that *submontana* and *vetusta* are not conspecific (see under *vetusta* Walker). We consider *submontana* Inoue to be the valid name to designate the population of Japan: *E. griseola submontana* Inoue, stat. rev.

***Eilema (Collita) vetusta* (Walker, 1854)**

**Figs 10–16, 29, 30, 42, 43**

*Lithosia vetusta* Walker, 1854: 506. Type locality: ‘Shanghai, North China’. Holotype (by monotypy): female [BMNH].

*Lithosia Griseola* Hb. var. *Amurensis* Staudinger, 1892: 268, **syn. n.** Type locality: ‘Raddefskaja’. Lectotype: male [ZMHUB], **here designated.**

**Description.** **Adult** (Figs 10–16). Wingspan 33–38 mm. Ground colour of wings whitish testaceous or rarely brown. Costal margin of forewing paler than ground colour. Hindwing paler than forewing.

**Male genitalia** (Figs 29, 30). Similar to *E. griseola* but phallus without bifurcation on apical spur and with only one small thorn directed ventrally. Vesica divided into two lobes and bearing zone of smaller thorns on dorsal surface; also with small cornuti (4–13) of equal size situated in one row.

**Female genitalia** (Figs 42, 43). Ductus bursae sclerotized in proximal half and without sclerotized protuberance. Ductus seminalis spiral-shaped (twisted around corpus bursae). Corpus bursae oviform with two signa situated on opposite sides.

**Diagnosis.** The species is characterized by the light colouration and rounded forewing. In male genitalia, by the phallus without terminal bifurcation and in the female genitalia, by the ductus bursae without sclerotized protuberance.

**Remarks.** Two subspecies are recognized: *E. vetusta vetusta* Walker on the mainland, and *E. vetusta aegrota* Butler in Japan.

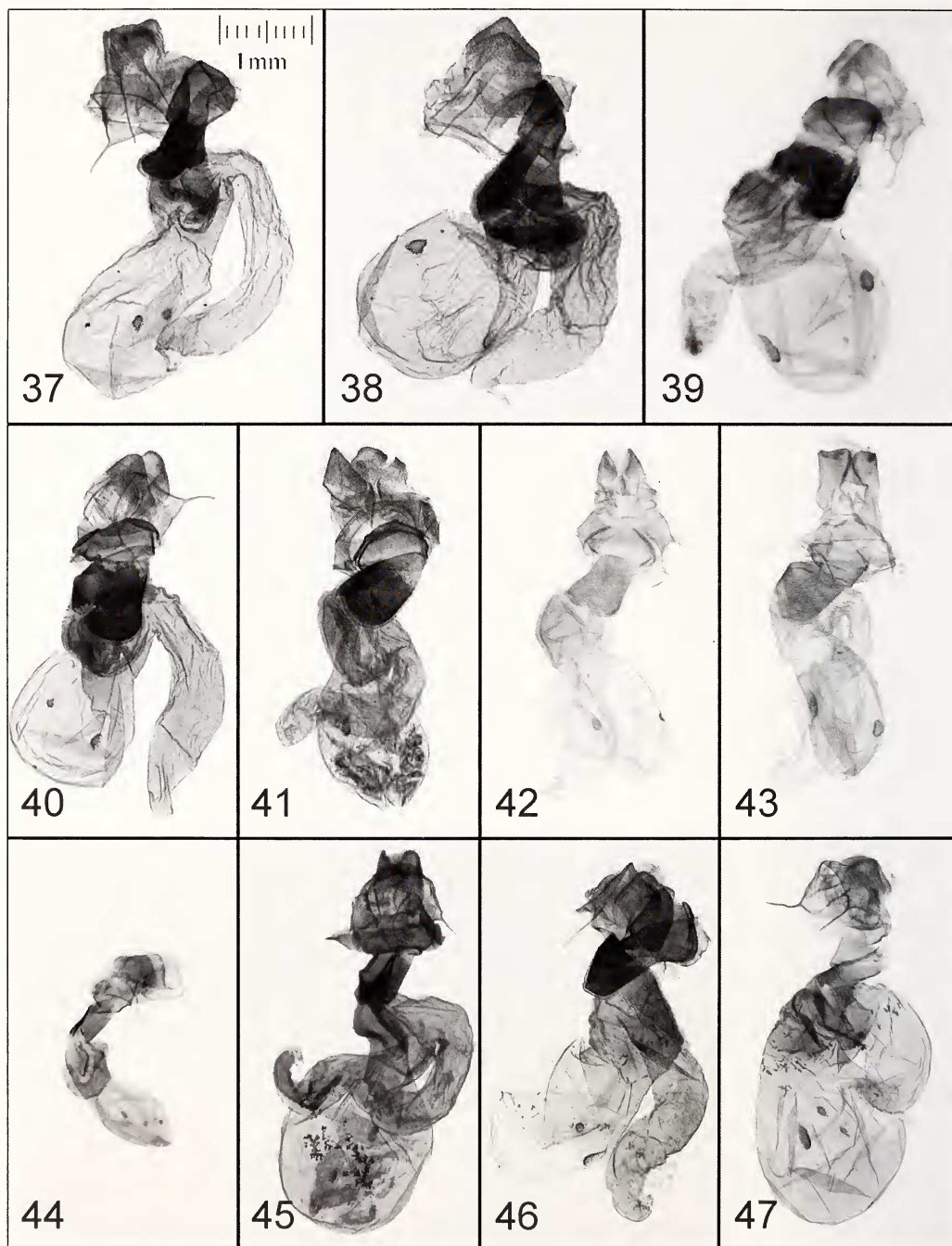
***Eilema (Collita) vetusta vetusta* (Walker, 1854)**

**Figs 10–14, 29, 42**

**Description.** **Adult** (Figs 10–14). Wingspan 33–36 mm. Ground colour of wings whitish testaceous. Costal margin of forewing paler than ground colour. Hindwing paler than forewing.

**Male genitalia** (Fig. 29). As described above.

**Female genitalia** (Fig. 42). As described above.



**Diagnosis.** The lighter colouration and smaller size (mostly 33–35 mm) separate this subspecies from the next.

**Distribution** (Fig. 49). Far East of Russia (Kirovsky, Ussuri Region), North China (Shanghai), Korea (Gensan).



**Remarks.** Our analysis of the genitalia structure of the holotype of *L. griseola* var. *amurensis* Staudinger, 1892, confirms that it is conspecific with *vetusta*. Both taxa (*griseola* and *vetusta*) coexist in several habitats in the Far East of Russia, China, and Korea. Dubatolov et al. (1993) have already synonymized *amurensis* with *vetusta*, but they considered the latter taxon to be a subspecies of *griseola*. We confirm here the indicated synonymy but reject the relationship of *vetusta* with *griseola*. Therefore, *E. vetusta* Walker, 1854 = *E. griseola amurensis* Staudinger, 1892, syn. rev.

The constant characters pointed above allow us to consider the taxon *E. vetusta* to be a separate species, not conspecific with *E. griseola*. In the original description, Staudinger (1892) stated the localities for his *Lithosia Griseola* Hb. var. *Amurensis* ('Amurgebiet', 'Nikolajefsk', 'Wlad[iwostock].', 'Ask[old island].', 'Sutschan' u. 'Suif[un].', and 'Radd[effskaja].'), but he did not mention the quantity of specimens of the type series nor did he designate a holotype. To clear up this situation and for taxonomic stability (Article 74 of the ICZN, forth edition) a male lectotype is designated here for *Lithosia Griseola* Hb. var. *Amurensis* Staudinger, 1892. This male bears the following labels: a violet locality label 'Raddefskaja | Chr.' <printed>, a white label 'v. *Amurensis* | Stgr. | (alle Originale)' <handwritten>, a red label with black printed text 'Origin', and a genitalia slide label 'Arct-Ig 05 | N. Ignatyev prep. 2006' <printed> is designated here as the lectotype. It has received an additional red printed label with 'LECTOTYPE | *Lithosia Griseola* Hb. | var. *Amurensis* Staudinger, 1892, | des. Ignatyev & Witt'. The lectotype is kept in the Zoological Museum of Humboldt University (Berlin, Germany). The other three (2♂ and 1♀) syntypes in ZMHUB are considered to be paralectotypes.

***Eilema (Collita) vetusta aegrota* (Butler, 1877), stat. n.**

**Figs 15, 16, 30, 43**

*Lithosia aegrota* Butler, 1877, *Ann. Mag. nat. Hist.* (4) 20 (119): 397. Type locality: 'Hakodaté'. Type: male [BMNH].

*Lithosia adaucta* Butler, 1877, syn. rev., *Ann. Mag. nat. Hist.* (4) 20 (119): 398. Type locality: 'Hakodaté'. Holotype: male [BMNH].

**Description.** A d u l t (Figs 15, 16). Wingspan (36–38 mm). Ground colour of forewing brown, darker than in nominate subspecies. Costal margin of forewing paler than ground colour. Hindwing paler than forewing, yellow.

**Figs 37–47.** Female genitalia. **37.** *Eilema griseola griseola* Hübner, Russia, Siberia centr., Barnaul (GU 11.056) [MWM]. **38.** *Eilema griseola griseola* Hübner, Russia, South Primorye, Pogranitshnyi (GU 11.057) [MWM]. **39.** *Eilema griseola griseola* Hübner, Middle Corea, Utikongo (500 m) in Kongosan (GU 11.062) [MWM]. **40.** *Eilema griseola griseola* Hübner, Korea, Prov. Ryang-gyang, Hyesan, room of Hotel Hyesan (GU 11.055) [MWM]. **41.** *Eilema griseola sachalinensis* Matsumura, USSR, South Sakhalin, Juzhno-Sakhalinsk (GU 11.078) [MWM]. **42.** *Eilema vetusta vetusta* Walker, holotype of *Lithosia vetusta* Walker (Arctiidae genitalia slide No. 690) [BMNH]. **43.** *Eilema vetusta aegrota* Butler, holotype of *Lithosia adaucta* Butler (Arctiidae genitalia slide No. 689) [BMNH]. **44.** *Eilema gina* Okano, Japan, Wariyama, Araya, Akita city (GU 11.493) [MWM]. **45.** *Eilema okanoi* Inoue, Japan, Kyushu, Fukuoka pref., Mt. Hikosan, 800m. (GU 11.053) [MWM]. **46.** *Eilema digna* Ignatyev et Witt, sp. n., paratype (GU 10.985) [MWM]. **47.** *Eilema chinensis* Daniel, paralectotype of *Lithosia griseola chinensis* Daniel (GU 11.059) [ZFMK].

**Male genitalia** (Fig. 30). Similar to nominate subspecies, but ramus more curved and less sharpened apically. Number of cornuti more constant, varying from 4 to 7, all cornuti almost equal in size.

**Female genitalia** (Fig. 43). As nominate subspecies.

**Diagnosis.** The subspecies differs from the nominate one by the larger size (36–38 mm) and darker colouration (mostly brownish-grey). The male genitalia also have a more constant number of cornuti, varying from 4 to 7 (4–13 in *vetusta*).

**Distribution** (Fig. 49). Japan (Hokkaido, Honshu (Hakone), Shikoku, Kyushu, Yakushima).

**Remarks.** We consider *Eilema vetusta aegrota* as the insular subspecies native to Japan. We separate this taxon on the basis of its geographical isolation, as well as external and genitalic differences. Dubatolov (1991: 185) considered the taxon *aegrota* Butler as a separate species, differing from the Euro-Asiatic *E. griseola* based on the structure of their genitalia. However, *E. aegrota* is conspecific with *E. vetusta* Walker. The name *aegrota* can be attributed to the population of Japan whereas the name *vetusta* designates the populations of mainland Russia, China, and Korea. A new status as a subspecies is established here for the populations of Japan: *E. vetusta aegrota* Butler, 1877. Moreover, the taxon *adaucta* Butler, which was described from Hakodaté, falls into synonymy with *E. vetusta aegrota*, on the basis of the sympatric range and the identical genitalia structure. The types of both taxa were examined in the BMNH. Both names, *aegrota* Butler and *adaucta* Butler, were introduced by Butler in the same paper on the same page. Both are without doubts synonyms and we consider the name *aegrota*, which was introduced in the text before *adaucta*, to have precedence as the first revisor's choice (ICZN Article 24.2.2, 1999).

### *Eilema (Collita) coreana* (Leech, 1888)

**Figs 17, 31**

*Lithosia coreana* Leech, 1888: 600, pl. 30 fig. 13. Type locality: 'Gensan'. Holotype by monotypy: male [BMNH].

**Description.** Adult (Fig. 17). Small species (wingspan: 25–27 mm). Forewing yellowish grey with smooth yellow costal streak; hindwing of same colour, but slightly paler. Head yellow. Tegulae and patagia uniformly dark coloured, concolorous with forewings and thorax.

**Male genitalia** (Fig. 31). Uncus wide distally and bearing a small thorn. Valvae symmetrical, strongly modified: saccular lobe with two appendages, a rounded upper one and a lower acute one; saccus wide at base, narrow and acute distally. Phallus long, narrow, without apical spur. Vesica covered regularly with numerous very small sclerotized thorns, also with two or three distinctly larger cornuti, and narrow stripe of middle-sized thorns.

**Female genitalia.** Unknown.

**Diagnosis.** Small size, yellowish grey colouration with tegulae and patagia uniformly dark coloured and concolorous with forewings and thorax, and distinct male genitalia characterize this taxon.

**Distribution.** Korea.



**Remarks.** The species was repeatedly mentioned from Far East of Russia as well as from Korea and Japan in many papers (Dubatolov et al., 1993; Inoue & Yamamoto, 1961) but all these records probably are misidentifications of *E. ussurica* Daniel, 1954, which belongs to another species group. In most collections seen the latter species is incorrectly identified under the name *coreana* Leech. The description of this species was based on one specimen taken near Gensan. No additional material was available to us. The small size, colour differences and the specific structure of the male genitalia allow us to consider *E. coreana* as a separate species belonging to a different clade that also includes the next species and that could eventually be considered as a separate monophyletic subgenus. For a long time *Eilema gina* Okano, 1954 [1955] was considered to be a synonym of *E. coreana* Leech, but see below.

***Eilema (Collita) gina* Okano, 1955**

**Figs 18, 19, 32, 32a, 44**

*Eilema gina* Okano, 1955: 62, figs 1–3. Type locality: [Japan] ‘Honshu, Morioka, Iwate Pref.’. Holotype: male [not found, probably in Iwate University].

**Description.** Adult (Figs 18, 19). Wingspan 17–19 mm. Forewing grey-brown, hindwing concolorous, both with narrow costal border of pale scales; costal margin of forewing distinctly pale yellow and wider basally, but base of costal stripe dark grey (almost black as in *E. griseola*) in males. Head and tegulae yellow; patagia, antennae, thorax, and abdomen concolorous with wings, but abdomen paler dorsally.

**Male genitalia** (Figs 32, 32a). Valvae symmetrical, with two appendages slightly curved and acute apically. Uncus wider in distal half, with small thorn at tip. Tegumen ribbon-shaped; ramus narrow and sharp in distal part. Phallus tubular, narrower in distal part and without bifurcation at apex. Vesica elongate with small appendage on dorsal surface, with narrow field of equally small cornuti on opposite side.

**Female genitalia** (Fig. 44). Papillae anales rounded. Posterior apophyses longer than anterior ones. Ductus bursae sclerotized in upper half. Ductus seminalis spiral-shaped and twisted around corpus bursae. Corpus bursae oviform with two small, rounded signa situated on opposite sides.

**Diagnosis.** This taxon is distinguished on the basis of its dark colouration (ground colour grey-brown) and the genitalia of the male: the vesica has a narrow field of specific small cornuti (Fig. 32). In contrast to other taxa, the hindwings of *E. gina* do not differ from the forewings in colouration. *Eilema gina* clearly belongs to the same group as *coreana* Leech (similar ground plan of the male genitalia) but differs distinctly by the smaller size (17–19 mm versus 23–25 mm), distinct yellow costal streak, wide external area of the forewing (in *coreana* Leech the fore and hindwings are of the same colour), and especially by the male genitalia structure where the uncus is much shorter and broadly rounded, the valvae different in shape, the ramus very short and robust, and the vesica without large cornuti, but with a field of numerous, equally small thorns only. In female genitalia the rounded papillae anales, the ductus bursae sclerotized in the upper half, the spiralled ductus seminalis, and the oviform corpus bursae with two signa situated on opposite sides distinguish *E. gina* from *E. coreana* without doubts.

**Distribution.** Japan (Honshu (Morioka), Akita city (Wariyama)). Recorded by Dubatolov et al. (1993) as *E. coreana* also from Tsushima island.

**Remarks.** Thanks to the courtesy of Mr. Yazunori Kishida, we were able to investigate three specimens of *Eilema gina* Okano, 1954 [1955]. The species has been considered for a long time as a synonym of *E. coreana* Leech. Surprisingly, in the original description, Okano compared *E. gina* with *E. japonica* Daniel, 1954 only, and mentioned a similarity in colouration of wings and distinct differences in the male genitalia of both taxa.<sup>1</sup>

Inoue & Yamamoto (1961) were the first to consider *E. gina* to be conspecific with *E. coreana* on the basis of the investigation of specimens and genitalia slides. Kobayashi (1969) also considered *E. gina* as a synonym to *E. coreana*, and compared it with *japonica* Daniel.<sup>2</sup> But the characters mentioned above in the diagnosis clearly show that *E. gina* is different from *E. coreana*.

### *Eilema (Collita) okanoi* Inoue, 1961

**Figs 20, 33, 45**

*Eilema okanoi* Inoue, 1961: 627. The name was introduced as replacement for *montana* Okano, 1954 [1955].

*Eilema griseolum montana* Okano, 1954 [1955]: 62. Type locality: [Japan] 'Honshu, Goshogake-ousen (ca. 1000 m.), Akita Préf.'. Holotype: male (not found, probably in Iwate Univ.). The name *montana* is a primary homonym of *Eilema montana* Aurivillius, 1910, *Sjöstedt Kilimanjaro-Meru Exp.* 2 (9): 27, pl. 1, fig. 12b.

**Description.** A d u l t m a l e . Wingspan 28–32. Ground colour of wings brown-grey; forewing costal streak yellow and wider in basal half; hindwing coloured evenly, paler than forewing; both wings with margin of pale scales. Head and tegulae yellow; patagia darker at tip; thorax dark-grey.

F e m a l e (Fig. 20) larger, with wingspan 32–34 mm; forewing grey; costal streak yellow and widening towards the base; hindwing uniformly grey, paler. Fore and hindwing with margin of pale scales. Head and tegulae yellow; patagia darker at tip; thorax dark grey.

Male genitalia (Fig. 33). Uncharacteristic, but phallus with elongate, sharpened apical spur.

F e m a l e g e n i t a l i a (Fig. 45). Papillae anales rounded. Ostium wide. Ductus bursae strongly sclerotized at base. Ductus seminalis with small appendage in cranial half; corpus bursae oviform with two rounded signa.

**Diagnosis.** Similar to *E. vetusta aegrota* Butler, but smaller (wingspan 28–34 mm versus 36–38 mm). Differs from *Eilema griseola* in male genitalia by the very characteristic, elongate, pointed apical spur of the phallus.

**Distribution.** The species is known from the Southern Kuriles (Kunashir, Shikotan, after Dubatolov, 1991) and Japan (Hokkaido, Honshu, Kyushu).

**Remarks.** The female is described here for the first time.

<sup>1</sup> 'Cette espèce voisine de *japonica*, quant à la coloration des ailes; s'en distingue par sa taille sensiblement inférieure et par la structure des genitalia males.'

<sup>2</sup> "...and sometimes liable to be confused with small aestival specimens of *japonica*, but fore wing lighter grey and the structure of male genitalia quite distinct from it in the shape of valve..."

***Eilema (Collita) digna* sp. n.****Figs 21, 22, 34, 46**

**Material.** Holotype: ♂, UdSSR [Russia], Far East, Primorye, Dorf Kamenuschka, VII. 1993, Lf., ex coll. Kautt [MWM] (GU 10.984). Paratypes: 1♀, UdSSR, Far East, Primorye, Dorf Kamenuschka, vii.1993, Lf., ex coll. Kautt [MWM] (GU 10985); 1♂, Primorskiy kray, Ussur. r., vill. Kaymanovka, 1975. vii.17, ex. coll. A. Tsvetaev [ZMMGU].

**Description.** Adult male (Fig. 21). Wingspan 36 mm. Forewing grey with dark grey scales at base of costal margin and with cilia dirty yellow. Hindwing dark yellow with paler cilia. Head yellow; patagia with grey scales at tip. Abdomen dorsally grey, with paler tip.

Male genitalia (Fig. 34). Uncus long, slightly curved and terminally acute. Tegumen ribbon-shaped. Valvae symmetrical, not serrate on distal margin, without sharpened costal lobe, with hook-shaped appendages in lower third. Phallus tubular, expanding towards base. Opening of vesica dorsal; vesica elongate with small lobe on upper third; with 6 cornuti of different sizes on distal side and numerous very small thorns on opposite surface.

Female (Fig. 22) larger than male (wingspan 47 mm). Ground colour of wings grey and paler than in male. Costal margin of forewing pale yellow, wider at base. Hindwing dirty yellow with paler cilia. Head yellow; patagia with admixture of grey scales. Dorsal side of abdomen grey, bearing pale scales at tip.

Female genitalia (Fig. 46). Papillae anales rounded, with shallow emargination medially. Ostium sclerotized. Ductus seminalis wide, S-shaped. Corpus bursae oviform, with two signa of different shapes.

**Diagnosis.** The species differs from other species in the larger size and the width and shape of the forewing, which has the apex distinctly expressed. The structure of the male genitalia should be used for safe identification. The genitalia of both sexes are very characteristic with the valvae symmetrical and the saccus bearing a long, curved and acute lower sclerotized lobe.

**Distribution.** The taxon is known so far only from its type locality in Far East of Russia.

***Eilema (Collita) chinensis* (Daniel, 1954)****Figs 23, 24, 35, 36, 47**

*Lithosia griseola chinensis* Daniel, 1954: 109, figs 64, 65. Type locality: [China, Prov. Shaanxi] 'Prov. Shansi, Mien-Shan, obere Höhe, ca. 2000 m.'. Lectotype: male [ZFMK], **here designated**.

**Description.** Adult male (Fig. 23). Wingspan 37–39 mm. Forewing yellowish grey with paler costal streak more distinctly expressed in first third. Hindwing paler. Head and patagia yellow; tegulae with admixture of dark scales. Abdomen yellow, more extensively coloured in distal half.

Male genitalia (Figs 35, 36). Uncus with small thorn at tip. Valvae asymmetrical, with external margins not serrate, with appendages on upper part curved anteriorly; ramus narrower at tip, its basal half widening (approximately twice). Phallus tubular, narrower at tip, without bifurcation in distal part, with one apical thorn. Vesica with 4–5 strong cornuti and zone of small sclerotized thorns.



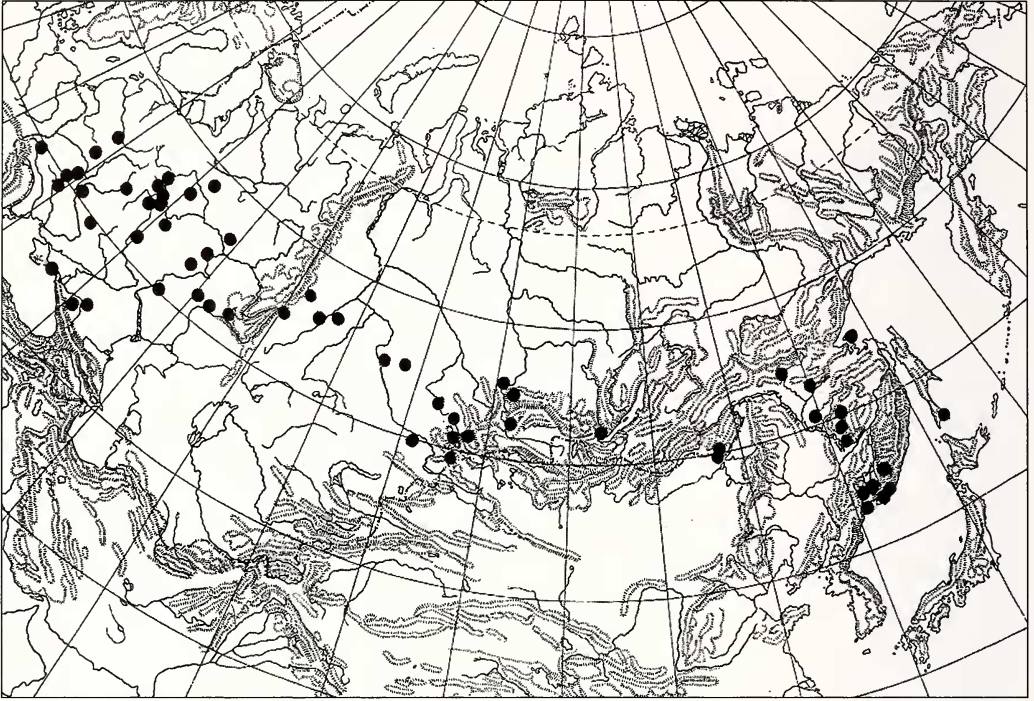


Fig. 48. Distribution of *Eilema griseola* in the Eastern Palearctic Region.



Fig. 49. Distribution of *Eilema vetusta*.

**Female** (Fig. 24). Smaller, without sexual dimorphism in colouration and other external characters.

**Female genitalia** (Fig. 47). Uncharacteristic: vaginal plates absent, papillae anales rounded, ductus seminalis long, entwined around oviform corpus bursae with two signa. Ductus bursae with characteristic sclerotized plate, with tip directed cranially and widened distally.

**Diagnosis.** The species is generally paler than *E. griseola* Hübner. The apical thorn of the phallus appears to be the main diagnostic character for the separation of this species.

**Distribution.** The species is known from Mongolia (Daniel 1954: 109) and China: Shensi, Shaanxi, Heilongjiang (Manchuria).

**Remarks.** On the basis of the structure of the male genitalia we consider *E. chinensis* to be a valid species restricted to China. In the original description, Daniel gave figures of the male genitalia (under numbers GU 503, 524), but did not give the number of syntypes and did not segregate a holotype from those. Specimens with the labels “holotype” and “allotype” were found in the collection of ZFMK. However, these designations are not valid because they are not mentioned in the description. To clear up this situation and for taxonomic stability (ICZN Article 74, 1999) a lectotype for *Lithosia griseola chinensis* Daniel, 1954, is designated here from the original type series of Daniel. This male specimen in the ZFMK bears the following labels: ‘Mien-Shan (Prov. Shansi) | Obere Höhe ca. 2000 m | 12.7 1937. H. Höne’ <printed>, red label ‘Holotypus | *Lithosia griseola* | ssp. *chinensis* | Daniel 1947’ <printed> and printed on white paper ‘ARC-010 | N. Ignatyev prep. 2006’ is designated here as the lectotype. It received an additional red printed label with the text ‘LECTOTYPE | *Lithosia griseola* | *chinensis* Daniel, 1954, | des. Ignatyev & Witt’. All other specimens in ZFMK and MWM are paralectotypes. In the original description, Daniel mentioned the distribution of this taxon in the following way: “Während bei *griseola* von Europa über die Mongolei und Mandschurei bis Japan der ♂ Genitalapparat die beschriebene Form einheitlich bewahrt, fehlt bei den Stücken aus Shansi und Süd Shensi ... Lediglich die große Serie vom Mien Shan entstammt ausschließlich dem Sammelplatz “obere Höhe” und auch im Tapaishan wurde nur zwischen 1700 und 3000 m Höhe gesammelt. Ich betrachte deshalb ssp. *chinensis* als einen unter völlig veränderten Lebensbedingungen umgeformten Stamm und halte die übergangslose Differenz im Bau des ♂ Genitalapparates für bedeutend genug, ihre Abtrennung zu rechtfertigen.”

## Conclusions

The subgenus *Collita* proved to be represented in Europe by only a single species whereas it is represented in the East Palearctic Region by seven distinct species. More species of the complex are expected to be found at least in China. Distinct subspeciation can also only be observed in the East Palearctic Region in the case of *E. griseola* and *E. vetusta*. Both developed distinguishable subspecies in Japan, and *E. griseola* also on Sakhalin. The hypothesis that the age of *Collita* in Asia is older and that *E. griseola* colonized Europe more recently seems to be justified.

Two different phylogenetic lineages are distinct in the group under consideration; the *griseola*-lineage (with most species) and the *coreana*-lineage (with *coreana* and *gina* only). In most characters (symmetry of genital armature of males, shape of genital sclerites, wing shape, general distribution, etc.) the *coreana*-lineage seems to be more primitive and should be placed at the base of the *Collita*-branch.

The complex of *Eilema griseola* Hübner, now including seven species, can be characterized by the shapes of the valvae and phallus, which may be considered as autapomorphies.

During this investigation previous misidentifications were corrected (*E. coreana* auct. for *Eilema ussurica*, *E. gina* as misidentification of 'Japanese *coreana*', and others). The relationships between the *Collita* taxa (on the basis of the structure of male and female genitalia and external appearance) were discussed and, as a result, some old synonyms are re-established and new specific combinations for three taxa were stated (*Eilema vetusta aegrota* Butler, 1877, *Eilema griseola sachalinensis* Matsumura, 1930, and *Eilema chinensis* Daniel, 1954). *Eilema gina* Okano, 1954 [1955] is considered to be a separate species native to Japan, probably a vicariant of *Eilema coreana* Leech, 1888. For taxonomic stability three lectotypes were designated.

## Acknowledgements

For help in the work with the museums' collection material, technical provision, providing of photos and consultations the authors express their sincere thanks to Dr. Sergej Ju. Sinev (ZISP), Dr. Andrej V. Sviridov (ZMMGU), Mr. Igor Yu. Kostjuk (ZMKU), Mr. Ulf Buchsbaum and Dr. Axel Hausmann (ZSSM), Dr. Wolfram Mey (ZMHUB), Dr. Dieter Stünig (ZFMK), Mrs Svetlana V. Nedoshivina (SPbGU), Mr. Jeoff Martin and Mr. Martin Honey (BMNH). For the supply of material from Japan the authors express their gratuity to Dr. Yoshizawa Kazunori (DEHU) and Mr. Yazunori Kishida (Tokyo). For the general management and consultation the authors express their thanks to Dr. Vadim V. Zolotuhin (Uljanovsk, UIGPU) and Dr. Wolfgang Speidel (MWM). Moreover we thank Juliane Diller (ZSM) for providing references. The investigations of N. Ignatyev were financially supported by the Thomas-Witt-Stiftung in 2006.

## References

- Butler, A. G. 1877. Descriptions of new species of Heterocera from Japan. Part I. Sphinges and Bombyces. – *Annals and Magazine of Natural History, including Zoology, Botany, and Geology* (4) **20** (119): 393–404.
- Daniel, F. 1954. Beiträge zur Kenntnis der Arctiidae Ostasiens unter besonderer Berücksichtigung der Ausbeuten von Dr. h. c. H. Höne aus diesem Gebiet (Lep. Het.). III Teil: Lithosiinae. – *Bonner zoologische Beiträge* **5**: 89–138.
- Dubatolov, V. V. 1991. Moths from Southern Sakhalin and Kunashir, collected in 1989. Part 1. Macroheterocera, excluding Geometridae and Noctuidae. – *Japan Heterocerists' Journal* **161**: 182–187.
- Dubatolov, V. V. & Yu. A. Tshistjakov & J. Viidalepp. 1993. A list of the Lithosiinae of the territory of the former USSR (Lepidoptera, Arctiidae). – *Atalanta* **24** (1/2): 165–175.
- Dubatolov, V. V. & G. S. Zolotareno. 1990. [K faune medveditzeobraznykh tscheshuekrylykh (Lepidoptera: Nolidae, Arctiidae) Zapadno-Sibirskoj ravniny] To a fauna of arctioid moths (Lepidoptera: Nolidae, Arctiidae) of West Siberian plate. *Tschlenistonogie i Gelminty*. „Nauka“. Novosibirsk. Pp. 122–139 (in Russian).
- Freina, J. J. de & T. J. Witt 1987. Die Bombyces und Sphinges der Westpalaearktis (Insecta, Lepidoptera). I. Edition Forschung & Wissenschaft, München. 708 pp. (incl. 46 col. plates).
- Hübner, J. 1796–1838 [imprint "1796"]. Sammlung Europäischer Schmetterlinge. Bombyces. 194 pp., 83 pls. – Augsburg.



- Inoue, H. 1961. Checklist of the Lepidoptera of Japan. Part 6. Hyblaeidae – Sphingidae. Tokyo. Rikusuisha. Pp. 621–683.
- Inoue, H. 1982. Arctiidae. In: Inoue, H., Sugi, S., Kuroko, H., Moriuti, S. & A. Kawabe. 1982. Moths of Japan. Kodansha, Tokyo. Vol. 1. 966 pp., Vol. 2. 522 pp., 392 plates.
- Inoue, H. & H. Yamamoto 1961. A synonymic note on several Japanese species of the genus *Eilema* (Lepidoptera, Arctiidae). – Kontyu 29: 72–77.
- Kobayashi, H. 1969. On the genus *Eilema* from Japan (Lepidoptera, Arctiidae) – Transactions of the lepidopterological Society of Japan 20 (1 & 2): 41–52.
- Leech, J. H. 1888. On the Lepidoptera of Japan and Corea. – Part II. Heterocera, sect. I – Proceedings of the zoological Society of London, 1888: 58–655.
- Matsumura, S. 1930. New species and forms of Arctiidae from Japan. – Insecta matsumurana 5: 31–40.
- Okano, M. 1955. Le genre *Eilema* Hübner du Japon (Lep., Arctiidae, Lithosiinae). – Annual Report of the Gakugei Faculty of the Iwate University 7 (1954) 2: 61–64.
- Staudinger, O. 1892. Die Macrolepidopteren des Amurgebiets. 1. Theil. Rhopalocera, Sphinges, Bombyces, Noctuae. In: Romanoff, N. M., Mémoires sur les Lépidoptères 6: 83–658, pls 4–14.
- Walker, F. 1854. List of the specimens of Lepidopterous insects in the collection of the British Museum. Vol. 2. Edward Newman, London. Pp. 279–581.